

What is Claimed is:

[c1] An electronic device comprising:
a semiconductor chip including an integrated circuit having at least one electrostatic discharge sensitive device; and
a non-semiconductor chip, positioned in close proximity to said semiconductor chip, said non-semiconductor chip having at least one electrostatic discharge protection device, said electrostatic discharge protection device electrically connected to said electrostatic discharge sensitive device.

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[c2] The electronic device of claim 1, wherein said electrostatic discharge sensitive device is selected from the group consisting of transistors, diodes, resistors, capacitors, and inductors.

[c3] The electronic device of claim 1, wherein said electrostatic discharge protection device is selected from the group consisting of spark gaps, field emission devices diodes and gated diodes.

[c4] An electronic device comprising:
a semiconductor chip including an integrated circuit; and
a non-semiconductor chip, positioned in close proximity to said semiconductor chip, said non-semiconductor chip having at least one electrostatic discharge sensitive device and at least one electrostatic discharge protection device, said electrostatic discharge protection device electrically connected to said electrostatic discharge sensitive device.

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[c5] The electronic device of claim 4, wherein said electrostatic discharge sensitive device is selected from the group consisting of resistors, capacitors and inductors.

[c6] The electronic device of claim 4, wherein said electrostatic discharge protection device is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes.

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[c7]

The electronic device of claim 4, wherein:

said electrostatic discharge sensitive device is selected from the group consisting of resistors, capacitors and inductors;
said electrostatic discharge protection device is a spark gap; and
said spark gap and at least a portion of said electrostatic discharge sensitive device and are integrally formed.

[c8]

An electronic device comprising:

a semiconductor chip including an integrated circuit having at least one first electrostatic discharge sensitive device; and
a non-semiconductor chip, positioned in close proximity to said semiconductor chip, said non-semiconductor chip having at least one second electrostatic discharge sensitive device and at least one first electrostatic discharge protection device and at least one second electrostatic discharge protection device, said first electrostatic discharge protection device electrically connected to said first electrostatic discharge sensitive device and said second electrostatic discharge protection device electrically connected to said second electrostatic discharge sensitive device.

[c9]

The electronic device of claim 8, wherein:

said first electrostatic discharge sensitive device is selected from the group consisting of transistors, diodes, resistors, capacitors, and inductors; and
said second electrostatic discharge sensitive device is selected from the group consisting of resistors, capacitors, and inductors.

[c10]

The electronic device of claim 8, wherein said first and second electrostatic discharge protection devices is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes.

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[c11]

The electronic device of claim 8, wherein:

said first electrostatic discharge sensitive device is selected from the group consisting of transistors, diodes, resistors, capacitors, and inductors; said first electrostatic discharge protection device is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes; said second electrostatic discharge sensitive device is selected from the group consisting of capacitors, resistors and inductors; said electrostatic discharge protection device is a spark gap; and said spark gap and at least a portion of said electrostatic discharge sensitive device and are integrally formed.

[c12]

An electronic device comprising:

a dual chip stack comprising:
a semiconductor chip including an integrated circuit having at least one electrostatic discharge sensitive device; and
a non-semiconductor chip, attached to said semiconductor chip, said non-semiconductor chip having at least one electrostatic discharge protection device, said electrostatic discharge protection device electrically connected to said electrostatic discharge sensitive device.

[c13]

The electronic device of claim 12, wherein said electrostatic discharge sensitive device is selected from the group consisting of transistors, diodes, resistors, capacitors, and inductors.

[c14]

The electronic device of claim 12, wherein said electrostatic discharge protection device is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes.

[c15]

An electronic device comprising:

a dual chip stack comprising:
a semiconductor chip including an integrated circuit; and

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a non-semiconductor chip, attached to said semiconductor chip, said non-semiconductor

chip having at least one electrostatic discharge sensitive device and at least one electrostatic discharge protection device, said electrostatic discharge protection device electrically connected to said electrostatic discharge sensitive device.

[c16] The electronic device of claim 15, wherein said electrostatic discharge sensitive device is selected from the group consisting of resistors, capacitors and inductors.

[c17] The electronic device of claim 15, wherein said electrostatic discharge protection device is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes.

[c18] The electronic device of claim 15, wherein:
said electrostatic discharge sensitive device is selected from the group consisting of
resistors, capacitors and inductors;
said electrostatic discharge protection device is a spark gap; and
said spark gap and at least a portion of said electrostatic discharge sensitive device
and are integrally formed.

[c19] An electronic device comprising: a
dual chip stack comprising:
a semiconductor chip including an integrated circuit having at least one first
electrostatic discharge sensitive device; and
a non-semiconductor chip, positioned in close proximity to said semiconductor
chip, said non-semiconductor chip having at least one second electrostatic discharge sensitive device and at least one first electrostatic discharge protection device and at least one second electrostatic discharge protection device, said first electrostatic discharge protection device electrically connected to said first electrostatic discharge sensitive device and said second electrostatic

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discharge protection device electrically connected to said second electrostatic discharge sensitive device.

[c20] The electronic device of claim 19, wherein:
said first electrostatic discharge sensitive device is selected from the group
consisting of transistors, diodes, resistors, capacitors, and inductors; and
said second electrostatic discharge sensitive device is selected from the group
consisting of resistors, capacitors, and inductors.

[c21] The electronic device of claim 19, wherein said first and second electrostatic discharge protection devices are selected from the group consisting of spark gaps, field emission devices diodes and gated diodes.

[c22] The electronic device of claim 19, wherein:
said first electrostatic discharge sensitive device is selected from the group
consisting of transistors, diodes, resistors, capacitors, and inductors; said first electrostatic discharge protection devices is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes;
said second electrostatic discharge sensitive device is selected from the group
consisting of capacitors, resistors and inductors;
said electrostatic discharge protection device is a spark gap; and
said spark gap and at least a portion of said electrostatic discharge sensitive device
and are integrally formed.

[c23] An electronic device comprising:
a dual chip stack mounted on a module, said dual chip stack comprising:
a semiconductor chip including an integrated circuit having at least one electrostatic discharge sensitive device; and
a non-semiconductor chip, attached to said semiconductor chip, said non-semiconductor

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chip having at least one electrostatic discharge protection device, said electrostatic discharge protection device electrically connected to said electrostatic discharge sensitive device.

[c24] The electronic device of claim 23, wherein said electrostatic discharge sensitive device is selected from the group consisting of transistors, diodes, resistors, capacitors, and inductors.

[c25] The electronic device of claim 12, wherein said electrostatic discharge protection device is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes.

[c26] An electronic device comprising:
a dual chip stack mounted on a module, said dual chip stack comprising:
a semiconductor chip including an integrated circuit; and
a non-semiconductor chip, attached to said semiconductor chip, said non-semiconductor

chip having at least one electrostatic discharge sensitive device and at least one electrostatic discharge protection device, said electrostatic discharge protection device electrically connected to said electrostatic discharge sensitive device.

[c27] The electronic device of claim 26, wherein said electrostatic discharge sensitive device is selected from the group consisting of resistors, capacitors and inductors

[c28] The electronic device of claim 26, wherein said electrostatic discharge protection device is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes.

[c29] The electronic device of claim 26, wherein:
said electrostatic discharge sensitive device is selected from the group consisting of
resistors, capacitors and inductors;
said electrostatic discharge protection device is a spark gap; and
said spark gap and at least a portion of said electrostatic discharge sensitive device

and are integrally formed.

[c30]

An electronic device comprising:

a dual chip stack mounted on a module, said dual chip stack comprising:
a semiconductor chip including an integrated circuit having at least one
first

electrostatic discharge sensitive device; and

a non-semiconductor chip, positioned in close proximity to said
semiconductor

chip, said non-semiconductor chip having at least one second electrostatic
discharge sensitive device and at least one first electrostatic discharge
protection device and at least one second electrostatic discharge protection
device, said first electrostatic discharge protection device electrically connected
to said first electrostatic discharge sensitive device and said second electrostatic
discharge protection device electrically connected to said second electrostatic
discharge sensitive device.

[c31]

The electronic device of claim 30, wherein:

said first electrostatic discharge sensitive device is selected from the
group

consisting of transistors, diodes, resistors, capacitors, and inductors; and

said second electrostatic discharge sensitive device is selected from the
group

consisting of resistors, capacitors, and inductors.

[c32]

The electronic device of claim 30, wherein said first and second electrostatic
discharge protection devices is selected from the group consisting of spark
gaps, field emission devices, diodes and gated diodes.

[c33]

The electronic device of claim 30, wherein:

said first electrostatic discharge sensitive device is selected from the
group

consisting of transistors, diodes, resistors, capacitors, and inductors; said first
electrostatic discharge protection devices is selected from the group consisting
of spark gaps, field emission devices, diodes and gated diodes;

said second electrostatic discharge sensitive device is selected from the group

consisting of capacitors, resistors and inductors;

said electrostatic discharge protection device is a spark gap; and

said spark gap and at least a portion of said electrostatic discharge sensitive device

and are integrally formed.

[c34] A method of protecting an electrostatic discharge sensitive component from an electrostatic discharge event comprising:

forming said electrostatic discharge sensitive device on a semiconductor chip;

forming an electrostatic discharge protection device on a non-semiconductor chip;

and

electrically connecting said electrostatic discharge sensitive device to said electrostatic discharge protection device.

[c35] The method of claim 34, wherein said electrostatic discharge sensitive device is selected from the group consisting of transistors, diodes, resistors, capacitors and inductors.

[c36] The method of claim 34, wherein said electrostatic discharge protection device is selected from the group consisting of spark gaps, field emission devices, diodes and gated diodes.

[c37] The method of claim 34, further including attaching said non-semiconductor chip to said semiconductor chip to form a dual chip stack.

[c38] The method of claim 37, wherein said non-semiconductor chip is attached to said semiconductor by means selected from the group consisting of chip by solder balls and radio frequency bumps.

[c39] The method of claim 37, further including attaching said chip stack to a module by means selected from the group consisting of solder balls, wirebonds, radio frequency bumps and beam lead bumps.

[c40]

The method of claim 39, wherein said module is selected from the group consisting of pin grid arrays, ball grid arrays, surface mount technology modules, small outline packages, quad flat packages, leaderless chip carriers and tape automated bonded modules.

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